

# PATENT COOPERATION TREATY

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From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:  
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## PCT

### NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter II of the Patent Cooperation Treaty)

(PCT Rule 71.1)

Date of mailing  
(day/month/year) **30 OCT 2007**

Applicant's or agent's file reference

58653-1021

#### IMPORTANT NOTIFICATION

International application No.

PCT/US04/41499

International filing date (day/month/year)

09 December 2004 (09.12.2004)

Priority date (day/month/year)

Applicant

SUN CHEMICAL CORPORATION

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary report on patentability and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

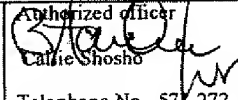
Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the *PCT Applicant's Guide*.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed invention is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

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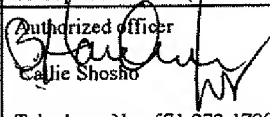
# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 58653-1021	<b>FOR FURTHER ACTION</b>		See Form PCT/IPEA/416																
International application No. PCT/US04/41499	International filing date (day/month/year) 09 December 2004 (09.12.2004)	Priority date (day/month/year)																	
International Patent Classification (IPC) or national classification and IPC IPC: Please See Continuation Sheet USPC: 523/160;524/277,487,490,491,556,563																			
Applicant SUN CHEMICAL CORPORATION																			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>8</u> sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p style="margin-left: 20px;">a. <input type="checkbox"/> (sent to the applicant and to the International Bureau) a total of ___ sheets, as follows:</p> <p style="margin-left: 40px;"><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p style="margin-left: 40px;"><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p style="margin-left: 20px;">b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p> <p>4. This report contains indications relating to the following items:</p> <table style="margin-left: 20px; border: none;"> <tr><td><input checked="" type="checkbox"/> Box No. I</td><td>Basis of the report</td></tr> <tr><td><input type="checkbox"/> Box No. II</td><td>Priority</td></tr> <tr><td><input type="checkbox"/> Box No. III</td><td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td></tr> <tr><td><input type="checkbox"/> Box No. IV</td><td>Lack of unity of invention</td></tr> <tr><td><input checked="" type="checkbox"/> Box No. V</td><td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td></tr> <tr><td><input type="checkbox"/> Box No. VI</td><td>Certain documents cited</td></tr> <tr><td><input type="checkbox"/> Box No. VII</td><td>Certain defects in the international application</td></tr> <tr><td><input type="checkbox"/> Box No. VIII</td><td>Certain observations on the international application</td></tr> </table>				<input checked="" type="checkbox"/> Box No. I	Basis of the report	<input type="checkbox"/> Box No. II	Priority	<input type="checkbox"/> Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	<input type="checkbox"/> Box No. IV	Lack of unity of invention	<input checked="" type="checkbox"/> Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	<input type="checkbox"/> Box No. VI	Certain documents cited	<input type="checkbox"/> Box No. VII	Certain defects in the international application	<input type="checkbox"/> Box No. VIII	Certain observations on the international application
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<input type="checkbox"/> Box No. VIII	Certain observations on the international application																		
Date of submission of the demand 29 June 2006 (29.06.2006)		Date of completion of this report 05 September 2007 (05.09.2007)																	
Name and mailing address of the IPEA/ US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201		Authorized officer  Carrie Shoshie Telephone No. 571-272-1700																	

Form PCT/IPEA/409 (cover sheet)(April 2005)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/US04/41499

Box No. I Basis of the report

1. With regard to the **language**, this report is based on:
  - ☒ the international application in the language in which it was filed.
  - ☐ a translation of the international application into English, which is the language of a translation furnished for the purposes of:
    - ☐ international search (under Rules 12.3 and 23.1(b))
    - ☐ publication of the international application (under Rule 12.4(a))
    - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))
2. With regard to the **elements** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):
  - ☒ the international application as originally filed/furnished
  - ☒ the description:
    - pages 1-10 as originally filed/furnished
    - pages\* NONE received by this Authority on \_\_\_\_\_
    - pages\* NONE received by this Authority on \_\_\_\_\_
  - ☒ the claims:
    - pages 11-15 as originally filed/furnished
    - pages\* NONE as amended (together with any statement) under Article 19
    - pages\* NONE received by this Authority on \_\_\_\_\_
    - pages\* NONE received by this Authority on \_\_\_\_\_
  - ☐ the drawings:
    - pages NONE as originally filed/furnished
    - pages\* NONE received by this Authority on \_\_\_\_\_
    - pages\* NONE received by this Authority on \_\_\_\_\_
  - ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
  - ☐ the description, pages \_\_\_\_\_
  - ☐ the claims, Nos. \_\_\_\_\_
  - ☐ the drawings, sheets/figs \_\_\_\_\_
  - ☐ the sequence listing (*specify*): \_\_\_\_\_
  - ☐ any table(s) related to the sequence listing (*specify*): \_\_\_\_\_
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
  - ☐ the description, pages \_\_\_\_\_
  - ☐ the claims, Nos. \_\_\_\_\_
  - ☐ the drawings, sheets/figs \_\_\_\_\_
  - ☐ the sequence listing (*specify*): \_\_\_\_\_
  - ☐ any table(s) related to the sequence listing (*specify*): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.  
PCT/US04/41499**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims <u>NONE</u>	YES
	Claims <u>1-38</u>	NO
Inventive Step (IS)	Claims <u>NONE</u>	YES
	Claims <u>1-38</u>	NO
Industrial Applicability (IA)	Claims <u>1-38</u>	YES
	Claims <u>NONE</u>	NO

**2. Citations and Explanations (Rule 70.7)**  
Please See Continuation Sheet

## Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

Continuation of IPC:

C09D 11/10( 2006.01);C08L 91/06( 2006.01),31/04( 2006.01),31/02( 2006.01);C08K 5/01( 2006.01)

V. 2. Citations and Explanations:

1. Claims 1-38 lack novelty under PCT Article 33(2) as being anticipated by Modi et al. (U.S. 2003/0149134).

Modi et al. disclose solvent free flexographic ink that is solid at room temperature, has a melting point of 75 C or greater, and when heated to a temperature between about 90 C and about 135 C forms a molten ink with viscosity of 100-1200 cPs, preferably 100-700 cPs. The ink comprises pigment, binder that is ethylene copolymer or hydrocarbon resin, wax including highly branched hydrocarbon wax, polyethylene homopolymer wax, oxidized polyethylene wax, animal wax such as spermaceti wax, and vegetable wax, solid linear alcohol, and solid plasticizer such as dicyclohexyl phthalate. The solid linear alcohol is a fully saturated long-chain linear alcohol having a melting point of about 75 C or greater, preferably 75-110 C and number average molecular weight of 350 or greater, preferably 350-750. The binder includes ethylene-acrylic acid copolymer having acid value of 40-120 and Brookfield viscosity at 140 of 550-650 cPs or ethylene-vinyl acetate copolymer containing 15-50%, preferably 40%, vinyl acetate and melt index of 8-2500, preferably, 52. The wax includes highly branched hydrocarbon wax having number average molecular weight of 520, softening point of 67 C, and viscosity at 99 C of 6 cPs and polyethylene homopolymer wax having number average molecular weight of 1000-1200, molecular weight distribution of 1-2 and melting point of 82-104 C. There is also disclosed method of preparing the composition identical to that presently claimed. Attention is drawn to example 1 that discloses ink comprising 8% solid alcohol, 2.5% plasticizer, 50% ethylene-acrylic acid copolymer, and 25% animal wax or highly branched hydrocarbon wax and to Table I, ink BLU3 which comprises 9.6% linear alcohol, 3% plasticizer, 25% ethylene-vinyl acetate copolymer, and 45% polyethylene wax (paragraphs 8-39, 43, 45, and 48-50).

2. Claims 1-2, 6, 15-17, 20, 25-26, and 31-32 lack novelty under PCT Article 33(2) as being anticipated by Brown et al. (U.S. 5,185,035).

Brown et al. disclose hot melt ink possessing viscosity of 5-100 cP at 100-130 °C wherein the ink comprises pigment 2-50% wax that includes mixtures of polyethylene wax and solid linear alcohol, and binder that is hydrocarbon resin. From Table III, it is clear that the binder is used in amount of, for instance, 48.5% (col.1, lines 8-10, col.2, lines 45-46, 52, and 56-58, col.3, lines 50-52, and col.6, lines 20-42). Although there is no disclosure of the melting point of the hot melt ink, given that Brown et al. disclose the use of ink

**Supplemental Box**

comprising same types and amounts of ingredients as presently claimed that has viscosity, i.e. 100 cP at 100-130 °C, as presently claimed, it is clear that the ink would inherently possess melting point as presently claimed.

3. Claims 1-2, 6-9, 12, 17, 20, 23, and 31-32 lack novelty under PCT Article 33(2) as being anticipated by Suematsu et al. (U.S. 5,597,641).

Suematsu et al. disclose solvent-free coating composition, i.e. hot meltable ink, that possesses viscosity of 20-200 cP at 90 °C and melting point of 60-85 °C wherein the coating comprises pigment, wax that includes combinations of beeswax, i.e. animal wax, polyethylene wax, and stearyl alcohol i.e. solid linear alcohol, and heat-meltable resin, i.e. binder, such as ethylene-vinyl acetate or ethylene-(meth)acrylic acid (col.6, lines 24-28, 31, 35-36, 39-40, 43-44, 46-47, and 66-67 and col.7, lines 40-42 and 52-53).

4. Claims 3-5 lack an inventive step under PCT Article 33(3) as being obvious over Brown et al. (U.S. 5,185,035) or Suematsu et al. (U.S. 5,597,641) either of which in view of Ouchi et al. (U.S. 6,106,602).

The disclosures with respect to Brown et al. and Suematsu et al. in paragraphs 2 and 3 above are incorporated here by reference.

The difference between Brown et al. or Suematsu et al. and the present claimed invention is the requirement in the claims of specific solid linear alcohol.

Ouchi et al., which is drawn to hot melt ink, disclose the use of alcoholic wax possessing hydroxyl number of 20-150, viscosity of 5-30 mPas at 100-150 °C, molecular weight of 200-1500, and melting point of 50-120 °C in order to produce ink with good stability (col.2, lines 3-19 and 53-56 and col.3, line 59-col.4, line 31).

In light of the motivation for using solid linear alcohol disclosed by Ouchi et al. as described above, it therefore would have been obvious to one of ordinary skill in the art to use such solid linear alcohol in the ink of Brown et al. or Suematsu et al. in order to produce ink with high optical transmission, hue, and chroma as well as good storage stability, and thereby arrive at the claimed invention.

5. Claim 10 lacks an inventive step under PCT Article 33(3) as being obvious over Suematsu et al. (U.S. 5,597,641) in view of Elwakil (U.S. 5,574,078) and Herten et al. (U.S. 4,853,427).

The disclosure with respect to Suematsu et al. in paragraph 3 above is incorporated here by reference.

The difference between Suematsu et al. and the present claimed invention is the requirement in the claims of specific type of ethylene-acrylic acid copolymer.

Elwakil, which is drawn to hot melt ink, disclose the use of ethylene-acrylic acid copolymer known under the tradename AC 580 in order to enhance gloss (col.14, lines 54-63). It is well known, as found in Herten et al., that AC 580 is ethylene-acrylic acid copolymer that possesses acid number of 80 and viscosity of 650 cP at 140 °C (col.7, lines 11-17).

In light of the motivation for using ethylene-acrylic acid copolymer disclosed by Elwakil as described above, it therefore would have been obvious to one of ordinary skill in the art to use such copolymer in the ink of Suematsu et al. in order to produce ink with enhanced gloss, and thereby arrive at the claimed invention.

6. Claims 13-14 lack an inventive step under PCT Article 33(3) as being obvious over Suematsu et al. (U.S. 5,597,641) in view of Kruse (U.S. 5,112,398).

The disclosure with respect to Suematsu et al. in paragraph 3 above is incorporated here by reference.

The difference between Suematsu et al. and the present claimed invention is the requirement in the claims of specific type of ethylene-vinyl acetate copolymer comprising 40% vinyl acetate.

Kruse, which is drawn to ink composition, disclose the use of ethylene-vinyl acetate comprising 40% vinyl acetate given that such copolymer adheres well to substrate (col.4, lines 48-52 and 63-66). Given that Kruse discloses ethylene-vinyl acetate comprising same amounts of ethylene and vinyl acetate as presently claimed, it is clear that such copolymer would also intrinsically possess melt index as presently claimed.

In light of the motivation for using specific type of ethylene-vinyl acetate disclosed by Kruse as described above, it therefore would have been obvious to one of ordinary skill in the art to use such ethylene-vinyl acetate in the ink of Suematsu et al. in order to produce ink that adheres well to substrate, and thereby arrive at the claimed invention.

7. Claims 18-19 lack an inventive step under PCT Article 33(3) as being obvious over Brown et al. (U.S. 5,185,035) or Suematsu et al. (U.S. 5,597,641) either of which in view of Oliver et al. (U.S. 5,593,486).

The disclosures with respect to Brown et al. and Suematsu et al. in paragraphs 2 and 3 above are incorporated here by reference.

The difference between Brown et al. or Suematsu et al. and the present claimed invention is the requirement in the claims of highly branched hydrocarbon wax.

Oliver et al., which is drawn to hot melt ink, disclose the use of highly branched hydrocarbon wax possessing number average molecular weight of 520 in order to produce ink with high optical transmission, hue, and chroma as well as to produce ink able to survive severe storage conditions without melting or offset (col.8, lines 25-27, col.8, line 67-col.9, line 2, and col.10, lines 43-47). Although there is no explicit disclosure regarding the softening point or viscosity of the highly branched hydrocarbon wax, given that Oliver et al. disclose the use of wax known under the tradename Vybar 253 which is identical to the highly branched hydrocarbon wax used in the present invention, it is clear that such wax would intrinsically possess softening point and viscosity as presently claimed.

In light of the motivation for using highly branched hydrocarbon wax disclosed by Oliver et al. as described above, it therefore would have been obvious to one of ordinary skill in the art to use such wax in the ink of Brown et al. or Suematsu et al. in order to produce ink with high optical transmission, hue, and chroma as well as good storage stability, and thereby arrive at the claimed

## Supplemental Box

invention.

8. Claims 21-22 lack an inventive step under PCT Article 33(3) as being obvious over Brown et al. (U.S. 5,185,035) or Suematsu et al. (U.S. 5,597,641) either of which in view of Oliver et al. (U.S. 5,593,486).

The disclosures with respect to Brown et al. and Suematsu et al. in paragraphs 2 and 3 above are incorporated here by reference.

The difference between Brown et al. or Suematsu et al. and the present claimed invention is the requirement in the claims of specific type of polyethylene wax.

Oliver et al., which is drawn to hot melt ink, disclose the use of polyethylene wax possessing number average molecular weight of 1000 in order to produce ink with high optical transmission, hue, and chroma as well as to produce ink able survive severe storage conditions without melting or offset (col.8, lines 25-27, col.9, lines 34-48, and col.10, lines 43-47). Although there is no explicit disclosure regarding the molecular weight distribution or melting point of the wax, Oliver et al. disclose the use of wax known under the tradename Polywax.

In light of the motivation for using specific polyethylene wax disclosed by Oliver et al. as described above, it therefore would have been obvious to one of ordinary skill in the art to use such wax in the ink of Brown et al. or Suematsu et al. in order to produce ink with high optical transmission, hue, and chroma as well as good storage stability, and thereby arrive at the claimed invention.

9. Claim 24 lacks an inventive step under PCT Article 33(3) as being obvious over Suematsu et al. (U.S. 5,597,641) in view of Sawada (U.S. 5,560,765).

The disclosure with respect to Suematsu et al. in paragraph 3 above is incorporated here by reference.

The difference between Suematsu et al. and the present claimed invention is the requirement in the claims of specific type of specific type of wax.

Sawada, which is drawn to hot melt ink, disclose the use of spermaceti wax in order to control the thermal characteristics and viscosity of the ink (col.2, lines 38-42 and col.3, line 30).

In light of the motivation for using spermaceti wax disclosed by Sawada as described above, it therefore would have been obvious to one of ordinary skill in the art to use such wax in Suematsu et al. in order to control the thermal characteristics and viscosity of the ink, and thereby arrive at the claimed invention.

10. Claims 27-30 lack an inventive step under PCT Article 33(3) as being obvious over Brown et al. (U.S. 5,185,035) or Suematsu et al. (U.S. 5,597,641) either of which in view of Jaeger et al. (U.S. 4,889,560).

The disclosures with respect to Brown et al. and Suematsu et al. in paragraphs 2 and 3 above are incorporated here by reference.

The difference between Brown et al. or Suematsu et al. and the present claimed invention is the requirement in the claims of plasticizer.

Jaeger et al., which is drawn to hot melt ink, disclose the use of up to 25% plasticizer such as dicyclohexyl phthalate plasticizer in order to increase the flexibility of the ink (col.4, lines 10-14, 21, and 44-45).

In light of the motivation for using dicyclohexyl phthalate plasticizer disclosed by Jaeger et al. as described above, it therefore would have been obvious to one of ordinary skill in the art to use dicyclohexyl phthalate in Brown et al. or Suematsu et al. in order to produce ink with increased flexibility, and thereby arrive at the claimed invention.

11. Claims 7-11 lack an inventive step under PCT Article 33(3) as being obvious over Brown et al. (U.S. 5,185,035) in view of Sandvick et al. (U.S. 5,700,516).

The disclosure with respect to Brown et al. in paragraph 2 above is incorporated here by reference.

The difference between Brown et al. and the present claimed invention is the requirement in the claims of ethylene-acrylic acid copolymer.

Sandvick et al., which is drawn to hot melt composition, disclose the use of ethylene-acrylic acid copolymer possessing acid number of 120 and viscosity at 140 °C of 650 cPs in order to provide flexibility to the composition (col.7, lines 4-6, col.8, lines 62-66, and col.21, lines 20-30).

In light of the motivation for using ethylene-acrylic acid copolymer disclosed by Sandvick et al. as described above, it therefore would have been obvious to one of ordinary skill in the art to use ethylene-acrylic acid copolymer in Brown et al. in order to produce ink with good flexibility, and thereby arrive at the claimed invention.

12. Claims 10-11 lack an inventive step under PCT Article 33(3) as being obvious over Suematsu et al. (U.S. 5,597,641) in view of Sandvick et al. (U.S. 5,700,516).

The disclosure with respect to Suematsu et al. in paragraph 3 above is incorporated here by reference.

The difference between Suematsu et al. and the present claimed invention is the requirement in the claims of specific type of ethylene-acrylic acid copolymer.

Sandvick et al., which is drawn to hot melt composition, disclose the use of ethylene-acrylic acid copolymer possessing acid number of 120 and viscosity at 140 °C of 650 cPs in order to provide flexibility to the composition (col.7, lines 4-6, col.8, lines 62-66, and col.21, lines 20-30).

In light of the motivation for using specific type of ethylene-acrylic acid copolymer disclosed by Sandvick et al. as described above, it therefore would have been obvious to one of ordinary skill in the art to use such ethylene-acrylic acid copolymer in Suematsu et al. in order to produce ink with good flexibility, and thereby arrive at the claimed invention.

## Supplemental Box

13. Claim 23 lacks an inventive step under PCT Article 33(3) as being obvious over Brown et al. (U.S. 5,185,035) in view of Sawada et al. (U.S. 5,965,196).

The disclosure with respect to Brown et al. in paragraph 2 above is incorporated here by reference.

The difference between Brown et al. and the present claimed invention is the requirement in the claim of animal wax.

Sawada et al., which is drawn to hot melt ink as is Brown et al., disclose the use of animal wax in order to control the thermal properties and viscosity of the ink. Further, Sawada et al. disclose the equivalence and interchangeability of using microcrystalline wax, as disclosed by Brown et al., with using animal wax as presently claimed (col.3, lines 28-30, 61-63, and 65).

In light of the above, it therefore would have been obvious to one of ordinary skill in the art to use animal wax in Brown et al. in order to control the thermal properties and viscosity of the ink, and thereby arrive at the claimed invention.

14. Claims 33-34 lack an inventive step under PCT Article 33(3) as being obvious over Brown et al. (U.S. 5,185,035).

Brown et al. disclose hot melt ink possessing viscosity of 5-100 cP at 100-130 °C wherein the ink comprises pigment, wax that includes mixtures of polyethylene wax and solid linear alcohol, and binder that is hydrocarbon resin (col.1, lines 8-10, col.2, lines 45-46, 52, and 56-58, col.3, lines 37-52, and col.6, lines 20-42). Although there is no disclosure of the melting point of the hot melt ink, given that Brown et al. disclose the use of ink comprising same types and amounts of ingredients as presently claimed that has viscosity, i.e. 100 cP at 100-130 °C, as presently claimed, it is clear that the ink would intrinsically possess melting point as presently claimed.

Brown discloses method of mixing the thermoplastic binder, wax, and linear alcohol (examples 14-18) to produce hot melt ink composition, however, there is no explicit disclosure of heating the composition to about 90 °C to about 135 °C to form hot melt coating which has coating viscosity between about 100 cPs and about 1200 cPs.

However, given that upon mixing the above ingredients, the ink is in solid form, it would have been obvious to one of ordinary skill in the art to heat the composition above the melting temperature so that the solid melts and the composition is able to function as a coating. Further, given that the composition of Brown would intrinsically possess melting point as presently claimed as discussed above and given that Brown et al. disclose viscosity as presently claimed, it would have been obvious to one of ordinary skill in the art to heat the composition of Brown et al. to temperature, including 100-130 °C, that is above the melting point so that the composition is flowable and able to cover substrate and that would produce desired viscosity, and thereby arrive at the claimed invention.

15. Claims 1-2, 6-8, 12, 15-17, 20, 23-26, 31-32, and 33-34 lack an inventive step under PCT Article 33(3) as being obvious over Sawada et al. (U.S. 5,965,196).

Sawada et al. disclose hot melt ink possessing melting point of 50 °C or above wherein the ink comprises 5-60% ethylene-vinyl acetate copolymer and 20-80% wax including mixtures of vegetable wax, animal wax, i.e. spermaceti, polyethylene wax, and linear alcohol wax. From the examples, it is seen that the coating is prepared by heating to temperature of 110 °C (col.2, lines 38-45, col.3, lines 15-21 and 63-65, col.3, line 67-col.4, line 1, col.4, lines 6-7 and 17-19, and col.5, lines 2, 15-16, 25-26, and 65-66). Although there is no explicit disclosure of the viscosity, given that Sawada et al. disclose ink comprising same type and amounts of ingredients as presently claimed wherein the ink has melting point as presently claimed, it is clear that the ink would also intrinsically possess viscosity as presently claimed.

16. Claims 3-5 lack an inventive step under PCT Article 33(3) as being obvious over the prior art as applied in the immediately preceding paragraph and further in view of Ouchi et al. (U.S. 6,106,602).

The difference between Sawada et al. and the present claimed invention is the requirement in the claims of solid linear alcohol.

Ouchi et al., which is drawn to hot melt ink, disclose the use of alcoholic wax possessing hydroxyl number of 20-150, viscosity of 5-30 mPas at 100-150 °C, molecular weight of 200-1500, and melting point of 50-120 °C in order to produce ink with good stability (col.2, lines 3-19 and 53-56 and col.3, line 59-col.4, line 31).

In light of the motivation for using solid linear alcohol disclosed by Ouchi et al. as described above, it therefore would have been obvious to one of ordinary skill in the art to use such solid linear alcohol in the ink of Sawada et al. in order to produce ink with high optical transmission, hue, and chroma as well as good storage stability, and thereby arrive at the claimed invention.

17. Claims 13-14 lack an inventive step under PCT Article 33(3) as being obvious over the prior art as applied in paragraph 15 and further in view of Kruse (U.S. 5,112,398).

The difference between Sawada et al. and the present claimed invention is the requirement in the claim of ethylene-vinyl acetate copolymer comprising 40% vinyl acetate.

Kruse, which is drawn to ink composition, disclose the use of ethylene-vinyl acetate comprising 40% vinyl acetate given that such copolymer adheres well to substrate (col.4, lines 48-52 and 63-66). Given that Kruse discloses ethylene-vinyl acetate comprising same amounts of ethylene and vinyl acetate as presently claimed, it is clear that such copolymer would also intrinsically possess melt index as presently claimed.

In light of the motivation for using specific type of ethylene-vinyl acetate disclosed by Kruse as described above, it therefore would have been obvious to one of ordinary skill in the art to use such ethylene-vinyl acetate in the ink of Sawada et al. in order to produce ink that adheres well to substrate, and thereby arrive at the claimed invention.

18. Claims 18-19 lack an inventive step under PCT Article 33(3) as being obvious over the prior art as applied in paragraph 15 and further in view of Oliver et al. (U.S. 5,593,486).

The difference between Sawada et al. and the present claimed invention is the requirement in the claims of highly branched hydrocarbon wax.



## Supplemental Box

Oliver et al., which is drawn to hot melt ink, disclose the use of highly branched hydrocarbon wax possessing number average molecular weight of 520 in order to produce ink with high optical transmission, hue, and chroma as well as to produce ink able to survive severe storage conditions without melting or offset (col.8, lines 25-27, col.8, line 67-col.9, line 2, and col.10, lines 43-47). Although there is no explicit disclosure regarding the softening point or viscosity of the highly branched hydrocarbon wax, given that Oliver et al. disclose the use of wax known under the tradename Vybar 253 which is identical to the highly branched hydrocarbon wax used in the present invention, it is clear that such wax would intrinsically possess softening point and viscosity as presently claimed.

In light of the motivation for using highly branched hydrocarbon wax disclosed by Oliver et al. as described above, it therefore would have been obvious to one of ordinary skill in the art to use such wax in the ink of Sawada et al. in order to produce ink with high optical transmission, hue, and chroma as well as good storage stability, and thereby arrive at the claimed invention.

19. Claims 21-22 lack an inventive step under PCT Article 33(3) as being obvious over the prior art as applied in paragraph 15 and further in view of Oliver et al. (U.S. 5,593,486).

The difference between Sawada et al. and the present claimed invention is the requirement in the claims of specific type of polyethylene wax.

Oliver et al., which is drawn to hot melt ink, disclose the use of polyethylene wax possessing number average molecular weight of 1000 in order to produce ink with high optical transmission, hue, and chroma as well as to produce ink able survive severe storage conditions without melting or offset (col.8, lines 25-27, col.9, lines 34-48, and col.10, lines 43-47). Although there is no explicit disclosure regarding the molecular weight distribution or melting point of the wax, Oliver et al. disclose the use of wax known under the tradename Polywax.

In light of the motivation for using specific polyethylene wax disclosed by Oliver et al. as described above, it therefore would have been obvious to one of ordinary skill in the art to use such wax in the ink of Sawada et al. in order to produce ink with high optical transmission, hue, and chroma as well as good storage stability, and thereby arrive at the claimed invention.

20. Claims 27-30 lack an inventive step under PCT Article 33(3) as being obvious over the prior art as applied in paragraph 15 and further in view of Jaeger et al. (U.S. 4,889,560).

The difference between Sawada et al. and the present claimed invention is the requirement in the claim of plasticizer.

Jaeger et al., which is drawn to hot melt ink, disclose the use of up to 25% plasticizer such as dicyclohexyl phthalate plasticizer in order to increase the flexibility of the ink (col.4, lines 10-14, 21, and 44-45).

In light of the motivation for using dicyclohexyl phthalate plasticizer disclosed by Jaeger et al. as described above, it therefore would have been obvious to one of ordinary skill in the art to use dicyclohexyl phthalate in Sawada et al. in order to produce ink with increased flexibility, and thereby arrive at the claimed invention.

21. Claims 1-38 meet the criteria set out in PCT Article 33(4), and thus the invention has industrial applicability because the subject matter claimed can be made or used in industry.

## NEW CITATIONS

✓ US 5,185,035 A (BROWN et al.) 09 February 1993, see col.1, lines 8-10, col.2, lines 45-46, 52, and 56-58, col.3, lines 50-52, and col.6, lines 20-42.

✓ US 5,597,641 A (SUEMATSU et al.) 28 January 1997, see col.6, lines 24-28, 31, 35-36, 39-40, 43-44, 46-47, and 66-67 and col.7, lines 40-42 and 52-53.

✓ US 6,106,602 A (OUCHI et al.) 22 August 2000, see col.2, lines 3-19 and 53-56 and col.3, line 59-col.4, line 31.

✓ US 5,574,078 A (ELWAKIL) 12 November 1996, see col.14, lines 54-63.

✓ US 4,853,427 A (HERTEN et al.) 01 August 1989, see col.7, lines 11-17.

✓ US 5,112,398 A (KRUSE) 12 May 1992, see col.4, lines 48-52 and 63-66.

✓ US 5,593,486 A (OLIVER et al.) 14 January 1997, see col.8, lines 25-27, col.8, line 67-col.9, line 2, and col.10, lines 43-47.

✓ US 5,560,765 A (SAWADA) 01 October 1996, see col.2, lines 38-42 and col.3, line 30.

✓ US 4,889,560 A (JAEGER et al.) 26 December 1989, see col.4, lines 10-14, 21, and 44-45.

✓ US 5,965,196 A (SAWADA) 12 October 1999, see col.2, lines 38-45, col.3, lines 15-21, 28-30, and 61-65, col.3, line 67-col.4, line 1, col.4, lines 6-7 and 17-19, and col.5, lines 2, 15-16, 25-26, and 65-66.

✓ US 5,700,516 A (SANDVICK et al.) 23 December 1997, see col.7, lines 4-6, col.8, lines 62-66, and col.21, lines 20-30.

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